

The Stinger: A Geotechnical Sensing Package for Robotic Scouting on a Small Planetary Rover, Phase II

Completed Technology Project (2017 - 2019)



Project Introduction

The first lunar soft lander was Surveyor 1, in 1966. It had three tasks, one of which was to determine lunar surface bearing strength. Knowing the strength of the lunar surface was the single most important parameter - this essentially dictated whether landing on the Moon with significant mass like that of the Lunar Module was in fact feasible. During the Apollo program, astronauts used a Self-Recording Penetrometer (SRP) to measure geotechnical properties of lunar soil. One of the instruments of the 1970 and 1976 Soviet Lunokhod rovers included a shear vane geotechnical tool. Since 1976, there have been no geotechnical instruments deployed on any planetary body. Our intent is to provide a geotechnical tool that will allow us to begin exploration again. The Apollo penetrometer approach was excellent for greater depths, while the Soviet approach worked well for the near-surface. We combine the two approaches into what we call the Stinger, a percussive shear vane penetrometer capable of measuring near-surface and subsurface soil properties to a depth of 50 cm or greater. The objectives of Phase I were to design and build a simplified breadboard Stinger GeoTool and test it in lunar and Martian soil simulants to determine its applicability for robotic and human missions. The results of Phase I show not only accuracy and precision in determining soil properties, but also flawless execution of the breadboard design. This paves the way for the Phase II effort. The primary objective of the proposed Phase II effort is to develop a compact impact shear vane penetrometer - the Stinger - up to TRL5/6 to determine soil physical properties near the surface and down to 50 cm depth. In conjunction with the instrument development, a soil mechanics model will be formulated based on laboratory tests with the instruments, in soil simulants, and in vacuum conditions.



The Stinger: A Geotechnical Sensing Package for Robotic Scouting on a Small Planetary Rover, Phase II Briefing Chart Image

Table of Contents

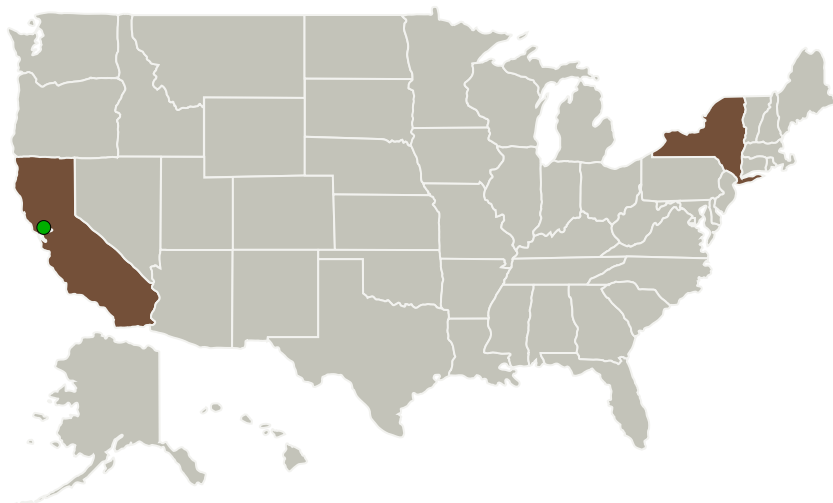
Project Introduction	1
Primary U.S. Work Locations and Key Partners	2
Project Transitions	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Images	3
Technology Areas	3
Target Destinations	3

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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Honeybee Robotics, Ltd.	Lead Organization	Industry	Pasadena, California
● Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations

California	New York
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Project Transitions

April 2017: Project Start

April 2019: Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/137659>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Honeybee Robotics, Ltd.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

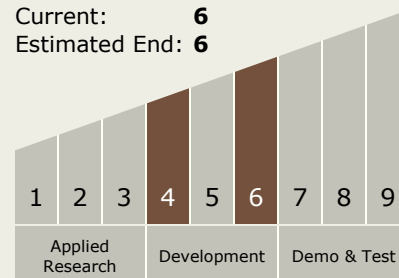
Carlos Torrez

Principal Investigator:

Kris Zacny

Technology Maturity (TRL)

Start: **4**
Current: **6**
Estimated End: **6**



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The Stinger: A Geotechnical Sensing Package for Robotic Scouting on a Small Planetary Rover, Phase II
(<https://techport.nasa.gov/image/130149>)

- TX04 Robotic Systems
 - └ TX04.3 Manipulation
 - └ TX04.3.2 Grappling Technologies

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System